3.9 LIGHT AND GLARE

3.9.1 Affected Environment

3.9.1.1 Applicable City of Seattle Policies

SEPA Policies

City of Seattle SEPA policies concerning light and glare state:

> *It is the City's policy to minimize or prevent hazards and other adverse impacts created by light and glare. If a proposed project may create adverse impacts due to light and glare, the decision maker shall assess the impacts and need for mitigation.*

DPR Lighting Performance Standards

The City of Seattle has identified the need to install lighting systems at athletic fields because of the limited availability of new open spaces for active recreation within the city and the need to increase athletic filed scheduling capacity (Seattle Department of Parks and Recreation, 2001). In response to concerns of neighborhood groups and individuals over the spill light and glare from sports field lights, the Department of Parks and Recreation commissioned a lighting study to develop a predictable method for planning, designing and developing sports field lighting systems. A portion of the ballfield lighting study report (McGowan Broz Engineers/DMD, 2001) addresses the impacts of extending sports play into the evening at City-owned facilities, and recommends a set of sports field lighting performance standards. The standards are described as follows:

> The maximum maintained vertical illuminance level for spill light must not exceed 0.8 fc [foot candles] (initial 1.1 fc) at the residential property line.
>
> The designer shall undertake initial vertical illuminance calculations on a line along the edge of the properties and roadways as defined by the City to establish compliance with the 0.8 fc level. The levels shall be calculated at five feet above grade.

3.9.1.2 Existing Light and Glare

Sand Point Magnuson Park/Project Site

Outdoor illumination currently exists at many locations within Sand Point Magnuson Park and at non-park facilities on the Sand Point peninsula. These primarily include exterior floodlights on buildings, street lights and parking lot lights. In number, the existing lights are concentrated in the western sector of the park, where most of the former Navy buildings are located, and are not within the project site. In general, these lighting features are not noticeable in the off-site vicinity of the Park.

The most prominent existing source of lighting within Sand Point Magnuson Park is Building 193, the former Navy Commissary facility located adjacent to NE 65th Street near the southern edge of both the

park and the project site. Perimeter lighting around this large building and the adjacent parking areas is extensive; combined with the light-colored exterior of the building, the effect is to make the Commissary highly visible in unscreened views from the surrounding area. The lights in this area are turned on intermittently for security purposes.

Two federal agency installations on the Sand Point site but not within the park boundaries also have extensive exterior lighting. The NOAA administrative complex on the north side of the peninsula occupies approximately 110 acres, and includes 10 buildings and their associated parking lots. The numerous exterior lights at this facility are plainly visible at night throughout much of the park, along a section of Sand Point Way NE, to varying degrees from the residential areas west of Sand Point Way, and in views from on or across Lake Washington. The USGS Western Fisheries Research Center on NE 65th Street, just south of the park and the project site, is a 5-acre complex with fewer, smaller buildings. Lights at the USGS facility are visible from much of the southern part of Sand Point Magnuson Park and from neighboring residential uses immediately to the west and south, but are generally not evident from locations farther to the west or south.

During daylight hours, existing sources of reflective glare in Sand Point Magnuson Park are limited. Windows and other highly reflective surfaces on buildings can generate glare. Given the prevailing architectural style of the buildings in the park, however, reflective surfaces and associated glare are not extensive. Vehicles in the park can also produce reflective glare.

Surrounding Vicinity

Lighting in the vicinity of Sand Point Magnuson Park comes from a variety of sources and displays a range of intensity. Lighting levels are of greatest intensity in the area along Sand Point Way NE. Several commercial and multi-family developments have building, parking lot and security lights that contribute to light levels along this corridor. The Children's Hospital administrative office building currently under construction on the west side of Sand Point Way will presumably have some additional exterior lighting. The View Ridge Swim and Tennis Club, located at NE 77th Street and Sand Point Way NE, has lighted tennis courts with spillover light onto Sand Point Way and nearby uphill residences. Streetlights along Sand Point Way NE are located about every 150 feet. Most of these contain 200-watt sodium vapor lamps, but their power ranges from 70 to 400 watts.

Lighting levels in the residential neighborhoods west of Sand Point Way are lower, consisting primarily of residential yard and house lighting and street lights. Street lights and exterior residential lighting in the uphill areas west of Sand Point Way are visible from the interior of the project site and elsewhere in Sand Point Magnuson Park. Landscaping vegetation around many of these residences has been maintained in low-growing form while taller trees exist in some places, so the visibility of lighting on the hillside is variable. Similar conditions apply to the residential area to the south of the project site, although exterior lighting levels in the Radford Court housing complex are somewhat higher than in adjoining single-family residential areas.

Commercial lighting along Sand Point Way, vehicles on local roadways, windows, and various other reflective surfaces within the vicinity of Sand Point Magnuson Park currently produce glare during daylight hours. In general, buildings along Sand Point Way and in adjacent areas do not have extensive reflective surfaces. Reflective glare can be created by vehicular traffic.

3.9.2 Environmental Impacts of the Proposed Action

The proposed action would significantly increase the amount of light in the area during evening hours. The lighting impacts may be assessed by evaluating two source components: the athletic field lighting, and the balance of the other lighting systems. The athletic field lighting represents over 90 percent of the light sources at the site. The balance of the project lighting would consist of parking lot, roadway, pathway, building perimeter and egress lighting systems. The "other lighting" systems utilize sources and lighting techniques that are comparable to the existing on-site lighting and do not represent a significant impact when scaled against the athletic field lighting, or against the lighting that now exists at the site.

The potential environmental impacts of the athletic field illumination consist of increased light levels inside the park, spillover light into the wetlands, spillover light onto areas outside of the park, glare and "sky glow".

Lighting terms used in this report are defined as follows; most are paraphrased from The IESNA Lighting Handbook, 8th Edition:

Foot-candle is a description of the amount of light striking a surface. It is equal to 1 lumen per square foot. You cannot see the light striking the surface, see luminance. Some examples of foot-candle levels are:

Full moonlight (approximate)	0.02
Lighted freeway, minimum	0.20
Lighted freeway, or residential roadway (avg)	1.00
Existing Sand Point building floodlights (max)	3.00
Residential street light (max)	5.00
Downtown Seattle streets	5.00
SPW cross walk (max)	10.00
Sports field, Class IV (proposed Sand Point - average)	30.00
Citgo gas station pumps on Sand Point Way (max)	40.00
Office building (interior average)	50.00
Safeco Field, Class I (average)	200.00

full cutoff luminaire is a luminaire (light fixture) which does not send any light upward. (Some organizations such as the International Dark Sky Association refer to this type of luminaire as a fully shielded luminaire, see the International Dark Sky Association's Outdoor Lighting Code Handbook, Section 5.02 or http://www.nofs.navy.mil/about_NOFS/staff/cbl/LC_Handbook_v11.html#cutoff.)

glare is the sensation produced by luminance within the visual field that is sufficiently greater than the luminance to which the eyes are adapted to, causing annoyance, discomfort, or loss in visual performance and visibility. IESNA breaks glare into several categories:

disability glare is the glare that results in reduced visual performance and visibility. It is often accompanied by discomfort. For example, if you are trying to observe Lake

Washington at night (a dark surface) from above and west of the park, direct or reflected light from inside the park can create a veiling luminance, that will disable your ability to view the lake. Another example is attempting to see a roadway with a setting or rising sun along the same line of sight.

discomfort glare produces a physical sensation of annoyance or pain, but without interfering with visibility.

In this report the term "glare" will most often refer to disability glare, or the presence of a veiling luminance. Glare, or disability glare, will be subdivided into direct and reflected elements, as follows:

direct glare describes when an observer can see directly into a luminaire's light source, where the lamp or the reflector are visible.

reflected glare describes when light reflected from a surface causes disability glare. It is assumed that the surface is not intentionally a light source. Surfaces attributable to reflected glare will have a higher luminance than adjacent or nearby surfaces.

Glare is sensitive to the position of the observer; a light source that prevents one observer from seeing can be helping a different observer at the same time.

light trespass is when spill light extends beyond the property line of the owner of a light source, and onto or above another owner's property.

luminance is the amount of light that is reflected off of a surface, in general terms it is proportional to the reflectance of the surface and the amount of light striking the surface. It is what we see, but because it varies with the viewer it is difficult to calculate.

sky glow is the haze or glow of light emitted above the lighting installation and reduces the ability to view the darkened night sky. This is a combination of light emitted directly from the light source, light reflected upward from the illuminated surface, and light reflected from airborne particles between the light source and the illuminated surface.

spill light is light from a source which does not strike the area intended for illumination. Spill light can be characterized by foot-candles (fc) calculated or measured in a vertical plane.

Figure 3.9-1 illustrates spill light and light trespass. **Figure 3.9-2** illustrates direct and reflected glare.

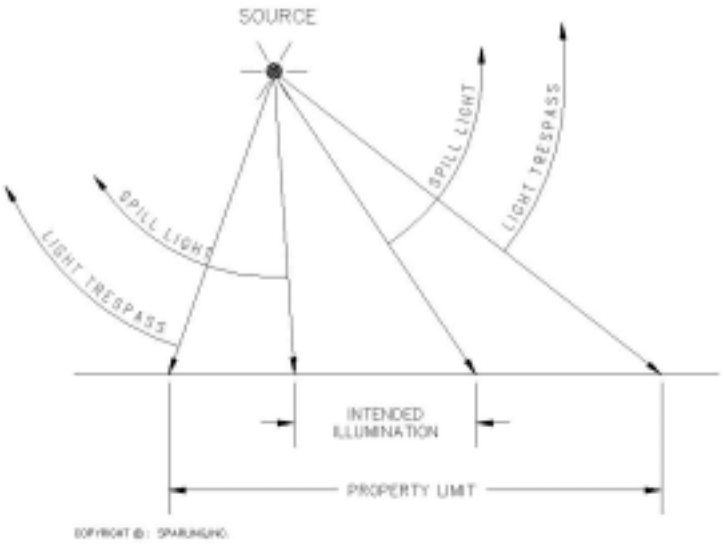

Figure 3.9-1
Spill Light and Light Trespass

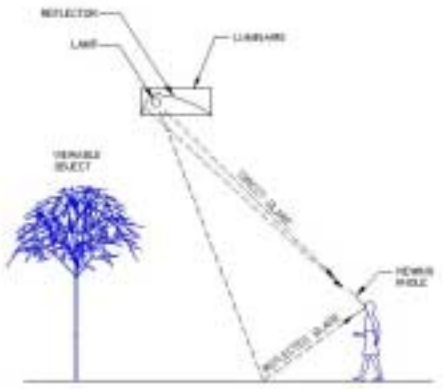

Figure 3.9.2
Direct and Reflected Glare

The Class IV light levels of 20 to 30 footcandles are the minimum recommended for safe play by the IESNA. The light level is comparable to most of the levels now present in the Seattle Parks system. The lighting systems selected for use with this project employ the latest technologies currently available, and control light much better than systems that were put in more than 5 years ago. So while the light levels are comparable to existing fields the control of light will be much better. The luminaires selected for the project consist of full-cutoff floodlights for nine of the lighted fields, and shielded floodlights with extended external visors for the remaining two fields. The proposed lighting systems are described in **Section 2.2.9**. As a point of comparison, **Table 3.9-1** gives examples of recreational field lighting systems in the Seattle area, and identifies whether the system uses older unshielded floodlights, or the newer shielded conventional or cutoff floodlights.

Spill light and light trespass, including direct glare, can be controlled through the use of luminaire locations, light distributions, aiming angles, and mounting heights. Placing luminaires close to the field with nearly downward aiming angles will minimize the spill light and direct glare components of light trespass. Pole mounting height and light distribution patterns can also be optimized, however field size and sport performance criteria can set minimum pole heights and daytime viewing aesthetics or maintenance restrictions can set maximum pole heights.

3.9.2.1 Spill Light

Spillover light can be quantified and measured. Over 95 percent of the spill lighting coming directly from the sports field luminaires would land on areas immediately adjacent to the fields, and inside the park boundaries. Some spill light would extend toward the wetland/habitat buffer area immediately adjacent to the sports fields.

Figure 3.9-3 is an illustration of the calculated lateral distribution of spill light (vertical foot-candles) from a typical sports field light system. The full cut-off system was chosen for analysis due to the fact that it generates more spill light behind the poles as compared to shielded floodlights. The graphic shows conditions specific to a little league baseball/fast-pitch softball field (Fields 9 through 11) proposed for Sand Point Magnuson Park; this field configuration was selected because Fields 9 and 10 would be the fields located closest to the wetland/habitat complex.

The numbers on the graphic indicate the calculated lighting intensity, in vertical foot-candles 5 feet above the field, at specific location intervals outside of the field. The lines show the distance away from the field at which the light level would fall off to 1 and 0.2 foot-candles. The distance from home plate to the outfield fence would be 225 feet for this field. As shown on the graphic, the light level beyond the fence line would diminish to 1 foot-candle at a distance of approximately 135 feet beyond the fence line, and to 0.2 foot-candle at approximately 205 feet beyond the fence line.

Table 3.9-1
Typical Existing Lighting Systems

NAME	TYPE OF FLOODLIGHT	LEVEL	FIELD SURFACE	REMARK
Des Moines Field House Park 1000 S. 220th Street Des Moines, WA	Shielded Conventional with Extended External Visor	IES Class IV 30 ft-c Infield 25 ft-c Outfield	Skinned Infields Natural Turf Outfields	Utility Field
Sacajawea Park 1405 Dash Point Road Federal Way, WA	Shielded Conventional with Extended External Visor	IES Class III 30 ft-c	Synthetic Turf	Soccer Field
Phil Johnson Fields 400 West Sievers-Ducey Blvd. Everett, WA	Full Cutoff Forward Throw Shoebox	IES Class IV 30 ft-c Infield 20 ft-c Outfield	Synthetic Turf Infields Natural Turf Outfields	4 Little League Fields
North SeaTac Park 13735 24th Avenue South SeaTac, WA	Full Cutoff Forward Throw Shoebox	IES Class IV 25 ft-c	All Weather	2 Soccer Fields
Marymoor Park 6046 West Lake Sammamish Parkway N.E. Redmond, WA	Unshielded Floodlights Full Cutoff Forward Throw Shoebox	IES Class IV 25 ft-c Soccer 30 ft-c Infield 20 ft-c Outfield	All Weather (Soccer) Skinned Infields Natural Turf Outfields (Softball)	Unshielded Floodlights at 2 Softball, 3 Soccer Fields & Velodrome Full Cutoff at 1 Soccer & 3 Softball Fields
Delridge Field 4458 Delridge Way S.W. Seattle, WA	Unshielded Floodlights	IES Class IV 30 ft-c Infield 20 ft-c Outfield	Skinned Infields Natural Turf Outfields (Softball)	Unshielded Floodlights at 2 Softball Fields with 1 Soccer Field Overlay
Lower Woodland Park 5201 Green Lake Way North Seattle, WA	Unshielded Floodlights Shielded Conventional with Extended External Visor	IES Class IV 20 ft-c Soccer 30 ft-c Infield 20 ft-c Outfield IES Class III 50 ft-c Infield 30 ft-c Outfield	All Weather (Soccer) Skinned Infields Natural Turf Outfields (Softball) Synthetic Turf Infield Natural Turf Outfield (Baseball)	Unshielded Floodlights at 4 Softball & 2 Soccer Fields (Fields #2-#7) Construction of Lighting System to be completed 8/01/02 (Field #1)

Figure 3.9-3
Typical Vertical Light Limits
Little League/Fast-pitch Softball Field
(225 feet from home plate to outfield fence)

The Department of Parks and Recreation has adopted a sports field lighting standard with a guideline that the maximum light level at the nearest residential property line should not exceed 0.8 vertical foot-candles maximum maintained (1.1 foot-candles initial), as discussed in **Section 3.9.1.** For the proposed light systems, this lighting level corresponds to a distance of no more than about 150 feet beyond the fence line for a given field. All of the lighted sports fields included in the proposed action would appear to meet this standard. For Field 14, the field closest to the Radford Court complex, the 150-foot distance corresponds to a location just south of NE 65th Street. The precise location of the 0/8 foot-candle limit relative to the property line for the Radford Court complex would need to be verified during detailed engineering design for the sports field lighting systems. The centerline of Sportsfield Drive would be approximately 125 feet from the fence lines of Fields 7, 11 and 12. There would be less spill light generated from Field 7 into Sportsfield Drive than shown with the use of the shielded floodlights. Consequently, the proposed action would not result in adverse spill light impacts for residential uses adjacent to the project site.

Issues relating to potential spill light and glare effects on wildlife are addressed in **Section 3.4 Animals and Fish**.

3.9.2.2 Glare

Light emanating from the park might be perceived as a source of glare by viewers inside or outside of the park. The presence of glare depends on the viewer's orientation, what the viewer is trying to see, and on the distribution of intervening buildings, terrain or vegetation. The primary sources of glare from the proposed action would be direct glare from the luminaires and reflected glare (luminance) from the surfaces in the park.

Direct glare would be a component of spillover light when viewable from outside of the park. Although direct glare would be visible from outside the park, the angles at which the light sources could be seen would be obscure enough to limit the amount of light to levels that are within the City of Seattle spill light standard.

The synthetic athletic field surfaces would be the greatest contributor to reflected glare. Light reflected from luminaire housings, luminaire visors and poles would also be a contributor. Reflected glare might be visible from any viewpoint overlooking the site. The impacts of glare are extremely difficult to quantify, as varying conditions such as ambient light levels, reflective characteristics of surfaces, and atmospheric conditions cause the level of impact to vary considerably.

During daylight hours the proposed action would not add any source of lighting that would cause any appreciably noticeable glare. In general, the number of structures with the potential to reflect daytime light in a specular manner, as is common with windows, would decrease. Daytime reflection and nighttime headlight glare from vehicular traffic would change in proportion to the amount of traffic in the park.

Direct Glare

The potential for the direct glare form of light trespass can be evaluated based on the proposed luminaire construction, mounting height and aiming angles. At any viewpoint inside or outside of the park, the

existence and amount of direct glare will be dependent on the distance to the luminaire and the elevation difference between the viewer and the luminaire. Light intensity decreases in proportion to the square of the distance from the light source. Also, raising a remote viewer's elevation will expose a viewer to less of the light coming from a luminaire that is aimed downward. The impact of direct glare decreases as a viewer get farther away from, and higher in relationship to, the location of a luminaire. While viewers at considerable distances from the sports fields could be exposed to direct glare, the illuminance level of the direct glare would not exceed the 0.8 fc lighting standard adopted by the City.

The street and parking lot luminaires would be mounted on 40-foot high poles. Because full-cutoff fixtures would be used for these lights, direct glare from these luminaires would be primarily confined to the boundaries of the park. The sports field lighting offers the greatest potential for direct glare to occur outside of the park. The sports field pole heights and luminaire types are described in **Section 2.2.9**. **Figure 3.9-4** includes plan-view and cross-sectional diagrams of a typical soccer field (with full-cutoff floodlights) and baseball field (shielded floodlights.

Full-cutoff athletic field luminaires are proposed at all fields, except Fields 7 and 8. No direct glare would be visible at elevations equal to or above the height of these luminaires, as the lamps and reflectors are fully shielded. The elevations of the play fields are 35 to 40 feet above sea level. The light poles for these fields add another 75-feet, giving a top elevation of 110 to 115 feet above sea level. Viewers at elevations above approximately 115 feet above sea level would not be exposed to direct glare from the athletic field light systems at all fields except, Fields 7 and 8.

Shielded floodlights (luminaires) are proposed for Fields 7 and 8, the two larger baseball/softball fields. The shielded floodlights do not completely cutoff the light, and direct glare would be visible above the level of the luminaire from outside the park, depending on the viewer's orientation relative to the aiming of the floodlights. The elevation of the playing surfaces of Fields 7 and 8 range from 35 to 37 feet above sea level. Six of the light poles at these fields would be 75 feet high, and two would be 85 feet high. The elevation at the top of the 85-foot poles would be approximately 120 to 122 feet above sea level. The luminaires would be aimed down to the field as much as possible to control direct glare.

On-Site Glare Exposure

The primary exposure to direct glare from the sports field lights would occur within the transitional housing area of the Sand Point campus, particularly at Building 224 (Santos Place). This building is located immediately to the west of Sportsfield Drive and directly across from the locations for Fields 7 and 11, respectively, and at a base elevation of approximately 50 feet. Because there is little intervening vegetation between Building 224 and the sports field complex location, views to the east from the structure would be fully exposed to direct glare from virtually all of the lit fields. Buildings 26N and 26S (located west of 62nd Avenue NE, across from Building 6) would also be exposed to direct glare from the field lights, although trees to the north and south would frame this exposure to a corridor including Fields 11 and 10, and perhaps some of the light poles at Fields 7 through 9 and 12 and 13. Elsewhere within the residential area of the Sand Point campus, such as at Buildings 330, 331 and 332, mature trees to the west of Sportsfield Drive should filter exposure to direct glare from the sports fields.

Figure 3.9-4
Sports Field Lighting Schematics

The Sand Point Community Housing Association is proposing to build 103 additional housing units on the Sand Point campus, consistent with the Sand Point Reuse Plan. Two locations considered for new housing construction are across 65th Street and across Sportsfield Drive from the proposed athletic field complex. General schematic drawings were prepared for both sites in 1996, but no further design work for the additional housing has been conducted since. The SPCHA expects to begin the design process in late 2002 and construction in 2003/2004. Depending upon the outcome of site selection and design, the additional housing could also be exposed to direct glare from the sports field lights.

Off-Site Glare Exposure

The cutoff fixtures would not be seen at viewing elevations above 115 feet, and the shielded floodlights are mounted at 125 feet. Above 125 feet only light from the floodlights on Fields 7 and 8 would cause direct glare, and then only if the luminaires have a component of light aimed at the viewer's direction. The 125-foot level sets a threshold for direct glare effects, and it is worth considering where this elevation lies in the adjacent community.

To the west of the project site, the terrain rises noticeably to the west of Sportsfield Drive and again to the west of Sand Point Way NE. In this area the 125-foot elevation contour runs generally along the west side of the Burke-Gilman Trail from about NE 60th Street up to NE 70th Street, and generally along the course of 58th Avenue NE between NE 70th Street and NE 82nd Street (USGS, 1968). The 125-foot contour in this area is located approximately 1,200 to 1,300 feet west of the project site. To the south of the project site, the 125-foot contour is located part-way up the hillside that forms Promontory Point within the park and in the general vicinity of NE 61st and NE 62nd Streets outside the park, at distances ranging from 400 to 1,000 feet from the project site. Off-site uses below the 125-foot level in this area are essentially limited to the Radford Court student-housing complex; the southern tiers of units in this complex appear to be situated above 125 feet in elevation.

Most of the single-family residential areas west of the Burke-Gilman Trail are above the 125-foot elevation. This area would not have exposure to direct glare from the cutoff luminaires, or from the shielded floodlights that are aimed eastward. They would only be exposed to direct glare from portions of the shielded floodlights on the 16 poles serving Fields 7 and 8, if the luminaires were oriented to the direction of the viewer.

Some of the units in the northerly and easterly portions of the Radford Court complex, which are generally at elevations ranging from about 50 to 125 feet above sea level, would have exposure to direct glare from the sports field lighting. Trees and other buildings in the complex would block views toward the project site and the sports field lights at some locations, while other locations would have a clear viewing path to the lights. In these cases, the direct glare exposure would most likely involve the southernmost sports fields, particularly Fields 14 and 15 and possibly Fields 12 and 13. These fields would be lit with full-cutoff fixtures at mounting elevations of about 110 feet above sea level, and residences in Radford Court (which would be a minimum of 200 to 250 feet from the closest field lights) would be subjected to the small mount of direct glare that would be present at an oblique viewing angle.

Motorists, pedestrians and bicyclists traveling along Sand Point Way NE, at elevations ranging from about 50 to 100 feet and at a distance of about 800 feet from the project site, would have brief, intermittent exposure to direct glare from the sports field lights. Similar conditions could apply to the

commercial and multi-family residential uses on the west side of Sand Point Way, depending on the specific locations of individual structures. As described in **Section 3.8.1**, trees and/or buildings block eastward views into Sand Point Magnuson Park from most locations on Sand Point Way.

Residences along or east of 58th Avenue NE and north of approximately NE 70th Street are at a low enough elevation that they might experience glare from multiple fields. This would depend upon site-specific physical characteristics; existing trees and buildings that block views toward the lights or limit the views to narrow corridors between buildings and tree clumps. Elsewhere in the View Ridge neighborhood, direct glare could be evident at various locations where the viewing elevation and lack of view blockage (by vegetation or structures) permit views into the interior of the project site.

Summary

In summary, locations outside the park but within the viewshed of the park and above an elevation of 125 feet could only be exposed to direct glare from some portion of the 100 sports field luminaires (out of 640 total in the park) used to light Fields 7 and 8. Potential off-site exposure to direct glare from these lights, and the number of lights involved in each case, would depend upon site-specific view corridor conditions. For viewers located at elevations below 125 feet, the chances of exposure to direct glare would be dependent on proximity to a sports field, the field use, and any intervening vegetation. Residences in certain locations would experience direct glare from a few of the light assemblies depending on the circumstances at each residence.

These conclusions should not be interpreted to mean that the sports field lights would not be evident or visible from the surrounding community. From a number of locations on View Ridge, for example, clear viewing paths to the project site exist and nighttime viewers would be able to see large arrays of luminaires in use at the sports fields. The sports field light systems would also be visible from more distant viewing locations with clear lines of sight to Sand Point Magnuson Park. This would include a large area of the surface of Lake Washington and considerable portions of the suburban development east of the lake.

The Seattle Department of Design, Construction and Land Use (DCLU) has been involved in reviewing permit applications for several sports field lighting projects at other Seattle parks. The recent DCLU impact evaluations for Woodland Park and the Genesee Playfield concluded that, with the inclusion of mitigating measures such as newer floodlight technology and limited hours of operation, light and glare impacts could be reduced to an insignificant level. Both of these proposals involved residential uses adjacent to the sports fields that would be lit. While these conclusions may not be directly transferable to the Sand Point Magnuson Park proposal, it should be noted that the nearest residences to the proposed fields would be at a distance of 300 feet.

3.9.2.3 Surface Luminance

When light strikes a surface, part of the light is reflected away from the surface; when reflected light strikes the eye, the surface can be seen. Luminance is a metric of the amount of light reflected from a surface. The nighttime luminance of surfaces within the park would significantly increase with the proposed action. The average illuminance would increase, as would the average surface reflectance, resulting in an overall increase in luminance.

In general terms the overall increase in luminance is assessed in **Table 3.9-2**. **Table 3.9-2** is intended to represent an overall average and magnitude. The PLP (unlighted) represents all surfaces within the park that are unlighted. The PLP (Spill Light) represents all surfaces within the park that are adjacent to intentionally illuminated spaces, but would receive spill light. The acreage indicated is a rough estimate.

Table 3.9-2
Surface Luminance, Existing and Proposed Conditions

Existing Conditions

Surface	Average Illuminance (FC)	Average Reflectance	Luminance (lumens/sf)	Acres
Entire Park				352
Park, Lawn & Planting (PLP) (Unlighted)	<0.2	5%	0.0	332
Park, Lawn & Planting (PLP) (Spill Light)	>0.2 FC and <1 FC	5%	.05	16
Impervious Surfaces (Lighted)	1	10%	0.1	4
Sports Fields (Lighted)	0	N/A	N/A	0

Proposed Action

Surface	Average Illuminance (FC)	Average Reflectance	Luminance (FL)	Acres
Entire Park				352
Park, Lawn & Planting (PLP) (Unlighted)	<0.2 FC	5%	0.0	236
Park, Lawn & Planting (PLP) (Spill Light)	>0.2 FC < 20 FC	5%	.5	82
Impervious Surfaces (Lighted)	1	10%	0.1	12
Sports Fields (Lighted)	25	20%	5	22

Actual luminance calculations with the system in place would be dependent on the angle at which light strikes the surface, the surface's degree of specular or diffuse reflective characteristics, and the angle at which the surface is viewed from. **Table 3.9-2** grossly simplifies what is necessary for luminance calculations, using just the illuminance multiplied by the reflectance to determine luminance. The sports fields would use an artificial turf. The reflectance of this turf is unknown, but it is estimated to be twice as bright as a typical concrete pavement, or about 20 percent.

Table 3.9-2 shows that the area of the park with a luminance of 0.2 FL or less would decrease from approximately 332 acres to 236 acres. It also indicates that the 22 acres used for sports fields would be 50 times brighter than any park surface that is presently illuminated.

With the sports field lights on, anyone with a view corridor to the sports field complex would notice the increase in surface luminance. In addition to the general luminance increase, there would be luminance hot spots at the sports field lighting poles and housings. The mounting arrangements of the luminaires would result in light from one luminaire striking the outside housing of another luminaire or striking the pole the luminaire is mounted on. While the area of the surfaces is small, these surfaces are very close to the light source, and would have a high luminance.

If an observer were trying to view a dark element within or in the vicinity of the park, the luminance of surfaces within the park could create reflected glare that prevented discernment of the dark element.

The increase in surface luminance means that there would be more light emanating from reflective surfaces in the park. This reflective light would travel in all directions and strike other surfaces within and outside of the park, and would be reflected again and again. Areas within and bordering the park would receive reflected light even if they did not receive light directly from a source. The potential for reflected light to be objectionable decreases in proportion to the square of the distance away from the light source and in direct proportion to the surface reflectance. Reflected light would rapidly dissipate with distance away from the park, but it would not immediately disappear. As with detailed luminance calculations, it is not possible to determine the magnitude and direction of reflected light that would cause light trespass. The City of Seattle has no ordinances addressing surface luminance or how light reflected off of a surface should be controlled (it would be very difficult to write, quantify, and enforce such an ordinance).

In summary, the proposed lighting system would significantly increase the average surface luminance within the park. The increased surface luminance could result in reflected glare and sky glow. Light reflected from surfaces within the park would contribute, to a limited extent, to increased ambient light in the vicinity of the park.

3.9.2.4 Sky Glow

The contribution of the proposed lighting systems to "sky-glow" would be from the floodlights emitting directly into the atmosphere and from light reflected by pavements, synthetic-turf surfaces, and nearby natural-turf areas. The extent of skyglow is dependent on how much water or particulate matter is in the air for the light to strike. There is no recognized industry standard to measure or quantify sky glow, although some methods such as star counting are in use.

The project site is located within an urbanized environment that is part of a large metropolitan area, extending along the I-5 and I-405 corridors. The sky above the metropolitan area is influenced by light sources located throughout the area. The park and the existing neighborhoods experience a base level of sky glow as a result of their location within this urbanized metropolitan environment. On a smaller scale, within the larger environment, the Sand Point and View Ridge neighborhoods are not as intensively developed as some of the nearby cityscapes. Portions of the park and nearby Lake Washington are comparatively darker pits in what is otherwise a sea of light.

The usual goal of a lighting system in minimizing sky glow is to control the amount of upward-directed light. Over 98 percent of the light from the proposed lighting system would be directed downward, leaving only a small component of light from the shielded floodlights traveling upward, and directly contributing to sky glow (see **Figure 3.9-5).** Although the direct component is controllable and would be minimized, light would be reflected upward (and in all other directions) from the illuminated sports fields and the surrounding terrain. The general increase shown for the park's surface luminance in **Table 3.9-2** is also indicative of the increase in light that would travel from the park into the air. The amount of light in the air above the park would increase significantly during the hours of operation for the sports field lights.

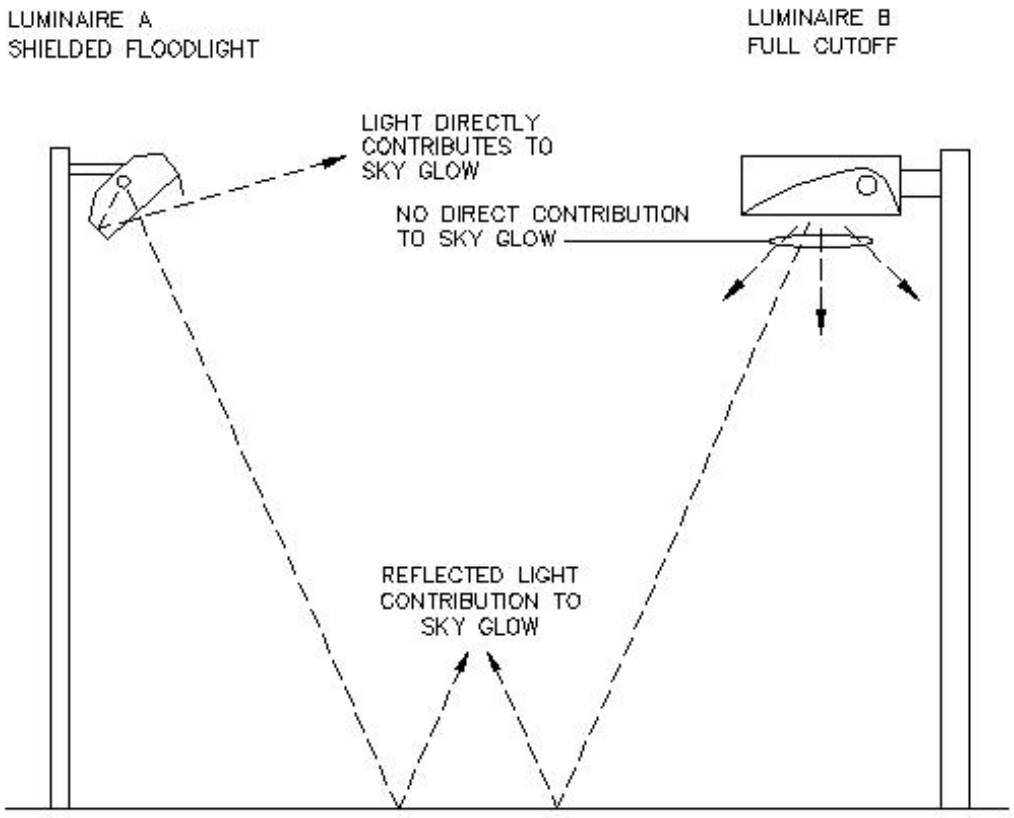

Figure 3.9-5
Sky Glow Contributions

The weather at the park is often humid, cloudy, rainy or otherwise prone to having airborne particles that will reflect light. Light emanating from the park would illuminate these particles, making them visible. Light would interreflect among particles, creating a glow in the air around the park. Light reflected from the particles could cause disability glare, compromising the ability of an observer to see naturally illuminated dark surfaces in the vicinity of the park or from seeing dim stars.

The proposed action would increase the glow of the sky in the metropolitan area when the field lighting systems were in use. The glow of the air around the park might be observable for several miles away from the park. On overcast nights, upward light might reach the clouds, permitting them to be seen when they otherwise would not.

3.9.3 Impacts of the Alternatives

3.9.3.1 Lesser-Capacity Alternative

Light and glare impacts under the lesser-capacity alternative would be of the same type and duration as the proposed action, but would be less in magnitude and extent. The primary differences between the alternatives would result from 3 lit sports fields under the lesser-capacity alternative compared to 11 for the proposed action. With 24 light poles rather than 80, and a similar reduction in the number of light fixtures, the amount of glare, sky glow and spillover light would be reduced proportionately. Under this alternative, the new sports field lighting systems would still represent a significant new source of light, glare, and luminance in the local area, primarily for the on-site transitional housing and, to a lesser degree, for nearby residential areas immediately to the west and south of the project site.

3.9.3.2 No Action Alternative

Sports field lighting and ancillary lighting systems would not be installed at Sand Point Magnuson Park with the no action alternative. Existing light sources on the project site would be reduced through the demolition of some existing buildings, most notably the former Commissary building that is lit brightly at night.

3.9.4 Cumulative Impacts

Either of the action alternatives would contribute to a general, long-term increase in night lighting levels and associated glare and sky glow (to a lesser degree) from various light sources in an existing urbanized environment. Some of the actions within Sand Point Magnuson Park that are pending or proposed under the Reuse Plan could add slightly to the extent of outdoor lighting evident in the vicinity of the park. Additional lights might be installed in the North Shore Recreation Area or the Community Campus area as existing structures and parking areas are refurbished, although it is unlikely there would be a substantial increase to the existing exterior lighting in these areas. The Off-Leash Area that will extend along the northern edge of the project site will, when completed, include a lighted corridor from the central sector of the park to the Lake Washington shoreline. This facility will employ the minimum practical lighting level and low-height light poles, however, so the new lights in the off leash area are not likely to add prominently to the existing light sources. A future tennis center is planned for a site near the northwest corner of the proposed project. This proposed facility would include lighted outdoor courts with light poles in the 30- to 40-foot range situated on the east side of the tennis center building, which

would partially obstruct visibility of these lights from the west. Demolition of the Commissary building will result in the removal of one prominent existing light source in the local area.

There are two proposals for increased development to the west of the project site. The Sand Point Community Housing Association is proposing to build 103 new housing units, likely in townhouse form, on the Sand Point campus. Exterior structure lighting and surface parking lighting from this development might add to the ambient lighting levels. On the west side of Sand Point Way NE, near NE 74th Street, several properties are underdeveloped relative to their current zoning (NC1-40). While no known development proposals are under consideration, development to the maximum allowable zoning would permit taller structures with exterior lighting on these sites.

Overall, the proposed action would likely result in significant light and glare impacts. The cumulative effect of all Sand Point Magnuson Park projects would be no greater than the combined effects of the individual projects. The sports field lighting would dominate over the visibility of any of the lighting considered in the other projects.

3.9.5 Mitigation Measures

Available technological measures to mitigate light and glare impacts from the proposed action have been incorporated into the design of the lighting systems. These include:

- use of full-cutoff lighting fixtures wherever possible;
- use of shielded lighting fixtures in remaining situations;
- meeting Department of Parks and Recreation requirements for maximum allowable light trespass levels from sports fields; and
- limiting lighting levels for ancillary lighting systems to the minimum required for safety and egress.

The impact analysis indicates there would likely be significant glare impacts for some facilities within the transitional housing area immediately to the west of the proposed sports field complex, and possibly at some units in the Radford Court complex to the south of the project site. In response to these impacts, it would be appropriate to consider other mitigation measures in addition to those identified above. Possible measures to consider include:

- restricted hours of operation of the sports field lights, either for the complex as a whole or for the fields closest the residential areas (Fields 7, 11 and 12 on the west side of the project site, and possibly Fields 14 and 15 on the south side)
- shielding to block or screen glare evident at Buildings 224, 26N, 26S and 6, if feasible physical measures can be identified
- additional trees between the lights and the affected areas and properties;
- higher poles and luminaire mounting heights would permit more downward aiming angles and greater control of the light. However higher poles are more visible during the day, only work if shielded floodlights are used, and are more expensive to construct and maintain.
- coordinating with plans for a second phase of on-site transitional housing, to develop a housing proposal that would be more compatible with athletic field lights

- evaluation of whether sports field design changes, such as rotating the orientation of the two baseball/softball fields with shielded floodlights, would reduce potential lighting impacts

Recent experience with evaluation of sports field lighting proposals by the Seattle Department of Design, Construction and Land Use (DCLU) indicate that it is possible to reduce sports field lighting impacts to insignificant levels through technological and operational mitigation measures. The first potential mitigation measure identified above, the possible restriction of the hours of sports field operation, would be capable of reducing the expected lighting impacts to insignificant levels. The decisionmakers for this proposal (the Mayor and the Seattle City Council) can evaluate the potential mitigation measures that are not included in the proposed action when they consider final action on the proposal.

3.9.6 Significant Unavoidable Adverse Impacts

Some of the specific light and glare impacts expected for the proposed action or the lesser-capacity alternative would represent significant adverse unavoidable impacts. Direct exposure to glare from the sports field lights at some residences immediately adjacent to the project site appears to be a significant impact that would be unavoidable, even with the mitigation features incorporated into the project design. Potential additional mitigation measures that have not been incorporated into the proposed action, particularly reduced hours of field operation, would be capable of reducing these lighting impacts to insignificant levels.

Beyond these immediately adjacent areas, terrain and vegetation conditions would adequately serve to limit direct glare from the lights. Some residents in areas farther to the west and south of the project site would notice the sports field lights in operation, even though they would not be directly exposed to glare, and would likely consider this to be a significant impact. This type of visible evidence of the lighting systems would be unavoidable. Light trespass from the sports fields would comply with the Department of Parks and Recreation standard for the maximum lighting level at the nearest residential property line, and therefore would not represent a significant impact on the built environment. There would be additional "sky-glow" impact under the proposed action, although it is not technically possible to measure the degree of skyglow change that would be attributable to the proposed action.